

TYPES 2N2904 THRU 2N2907, 2N2904A THRU 2N2907A P-N-P SILICON TRANSISTORS

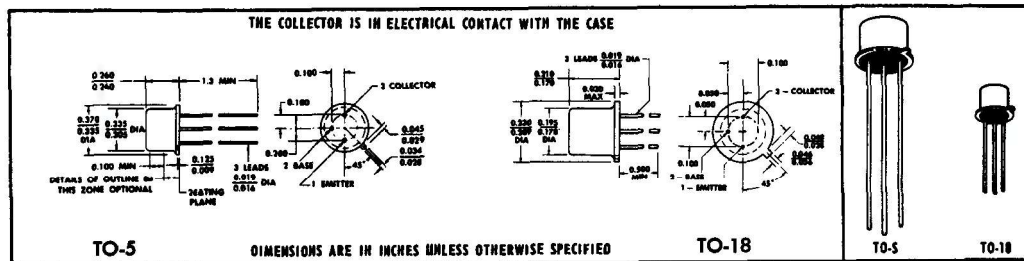
BULLETIN NO. OLS 7311915, MARCH 1973

DESIGNED FOR HIGH-SPEED, MEDIUM-POWER SWITCHING
AND GENERAL PURPOSE AMPLIFIER APPLICATIONS

- High Breakdown Voltage Combined with Very Low Saturation Voltage
- h_{FE} Guaranteed from 100 μA to 500 mA
- 2N2904, 2N2906 for Complementary Use with 2N2218, 2N2221
- 2N2905, 2N2907 for Complementary Use with 2N2219, 2N2222

*mechanical data

Device types 2N2904, 2N2904A, 2N2905, and 2N2905A are in JEDEC TO-5 packages.
Device types 2N2906, 2N2906A, 2N2907, and 2N2907A are in JEDEC TO-18 packages.



*absolute maximum ratings at 25°C free-air temperature (unless otherwise noted)

	2N2904 2N2905	2N2904A 2N2905A	2N2906 2N2907	2N2906A 2N2907A	UNIT
Collector-Base Voltage	-60	-60	-60	-60	V
Collector-Emitter Voltage (See Note 1)	-40	-60	-40	-60	V
Emitter-Base Voltage	-5	-5	-5	-5	V
Continuous Collector Current	-0.6	-0.6	-0.6	-0.6	A
Continuous Device Dissipation at (or below) 25°C Free-Air Temperature (See Notes 2 and 3)	0.6	0.6	0.4	0.4	W
Continuous Device Dissipation at (or below) 25°C Case Temperature (See Notes 4 and 5)	3	3	1.8	1.8	W
Storage Temperature Range	-65 to 200				°C
Lead Temperature 1/16 Inch from Case for 10 Seconds	230				°C

NOTES: 1. These values apply between 0 and 100 mA collector current when the base-emitter diode is open-circuited.
2. Derate 2N2904, 2N2904A, 2N2905, and 2N2905A linearly to 200°C free-air temperature at the rate of 3.43 mW/°C.
3. Derate 2N2906, 2N2906A, 2N2907, and 2N2907A linearly to 200°C free-air temperature at the rate of 2.28 mW/°C.
4. Derate 2N2904, 2N2904A, 2N2905, and 2N2905A linearly to 200°C case temperature at the rate of 17.3 mW/°C.
5. Derate 2N2906, 2N2906A, 2N2907, and 2N2907A linearly to 200°C case temperature at the rate of 10.3 mW/°C.

*JEDEC registered data. This data sheet contains all applicable registered data in effect at the time of publication.

USES CHIP P20

TYPES 2N2904 THRU 2N2907, 2N2904A THRU 2N2907A **P-N-P SILICON TRANSISTORS**

*electrical characteristics at 25°C free-air temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	TO-6 →	2N2904	2N2904A	2N2906	2N2906A	2N2907	2N2907A	UNIT
		TO-18 →	2N2906	2N2906A	2N2907	2N2907A	2N2907A	2N2907A	
			MIN	MAX	MIN	MAX	MIN	MAX	
V(BR)CBO	Collector-Base Breakdown Voltage	I _C = -10 μA, I _E = 0	-60		-60		-60		V
V(BR)CEO	Collector-Emittar Breakdown Voltage	I _C = -10 mA, I _B = 0, See Note 6	-40		-60		-40		V
V(BR)EBO	Emitter-Base Breakdown Voltage	I _E = -10 μA, I _C = 0	-5		-5		-5		V
I _{CBO}	Collector Cutoff Current	V _{CB} = -50 V, I _E = 0, T _A = 150°C	-20		-10		-20		nA
I _{CEV}	Collector Cutoff Current	V _{CE} = -30 V, V _{BE} = 0.5 V	-50		-50		-50		nA
I _{BEV}	Base Cutoff Current	V _{CE} = -30 V, V _{BE} = 0.5 V	50		50		50		nA
h _{FE}	Static Forward Current Transfer Ratio	V _{CE} = -10 V, I _C = -100 μA	20		40		35		
		V _{CE} = -10 V, I _C = -1 mA	25		40		50		
		V _{CE} = -10 V, I _C = -10 mA	35		40		75		
		V _{CE} = -10 V, I _C = -150 mA, See Note 6	40	120	40	120	100	300	
		V _{CE} = -10 V, I _C = -500 mA, See Note 6	20		40		30		
V _{BE}	Base-Emitter Voltage	I _B = -15 mA, I _C = -150 mA, See Note 6	-1.3		-1.3		-1.3		V
		I _B = -50 mA, I _C = -500 mA, See Note 6	-2.6		-2.6		-2.6		V
V _{CE(sat)}	Collector-Emittar Saturation Voltage	I _B = -15 mA, I _C = -150 mA, See Note 6	-0.4		-0.4		-0.4		V
		I _B = -50 mA, I _C = -500 mA, See Note 6	-1.6		-1.6		-1.6		V
h _{fe}	Small-Signal Common-Emitter Forward Current Transfer Ratio	V _{CE} = -20 V, I _C = -50 mA, f = 100 MHz	2		2		2		
C _{obo}	Common-Base Open-Circuit Output Capacitance	V _{CB} = -10 V, I _E = 0, f = 100 kHz	8		8		8		pF
C _{ibo}	Common-Base Open-Circuit Input Capacitance	V _{EB} = -2 V, I _C = 0, f = 100 kHz	30		30		30		pF

NOTE 6: These parameters must be measured using pulse techniques. t_{pw} = 300 μs, duty cycle ≤ 2%.

*JEDEC registered data

TYPES 2N2904 THRU 2N2907, 2N2904A THRU 2N2907A **P-N-P SILICON TRANSISTORS**

*switching characteristics at 25°C free-air temperature

PARAMETER	TEST CONDITIONS†	MAX	UNIT
t_d Delay Time	$V_{CC} = -30\text{ V}$, $I_C = -150\text{ mA}$, $I_{B(1)} = -15\text{ mA}$, $V_{BE(off)} = 0$, See Figure 1	10	ns
t_r Rise Time		40	ns
t_{on} Turn-On Time		45	ns
t_s Storage Time	$V_{CC} = -8\text{ V}$, $I_C = -150\text{ mA}$, $I_{B(1)} = -13\text{ mA}$, $I_{B(2)} = 17\text{ mA}$, See Figure 2	80	ns
t_f Fall Time		30	ns
t_{off} Turn-Off Time		100	ns

†Voltage and current values shown are nominal; exact values vary slightly with transistor parameters.

***PARAMETER MEASUREMENT INFORMATION**

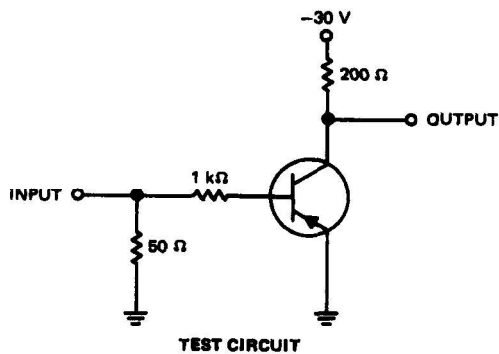


FIGURE 1

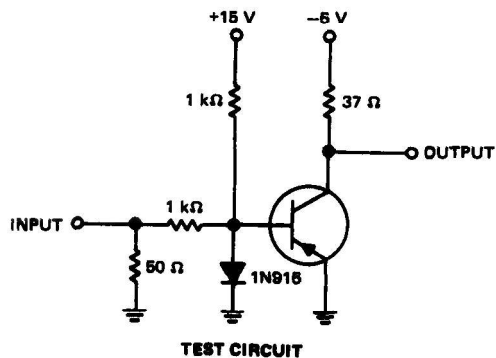
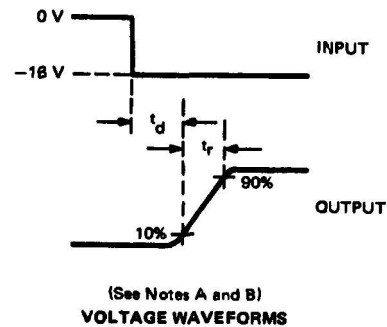
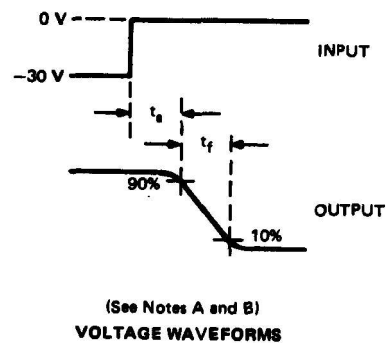


FIGURE 2



NOTES: A. The input waveforms are supplied by a generator with the following characteristics: $Z_{out} = 50\ \Omega$, $t_r < 2\text{ ns}$, $t_f < 2\text{ ns}$, $t_w = 200\text{ ns}$, $PRR = 160\text{ Hz}$.

B. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r < 5\text{ ns}$, $R_{in} = 10\text{ M}\Omega$.

*JEDEC registered data